

REMARKS

Claims 12, 16 through 18, and 20 have been amended. Claims 1 through 20 remain in the application.

Claims 1 through 8 and 12 through 20 were rejected under 35 U.S.C. § 103 as being unpatentable over Weimer (U.S. Patent Application Publication No. 2001/0017039) in view of Stark (U.S. Patent No. 6,116,040). Applicant respectfully traverses this rejection.

U.S. Patent Application Publication No. 2001/0017039 to Weimer discloses an electric system. FIGS. 1 and 1a show power electronics 20 for controlling an electric machine 70, wherein the electric machine 70 is a starter generator constructed as a permanently excited synchronous machine arranged in the drive train of a vehicle 76. The power electronics 20 comprise a component part 11 (see FIGS. 2 to 4) of a control device which is to be cooled. However, the component part 11 may alternatively comprise the electric machine 70. The power electronics 20 have a housing 29 produced as an aluminum deep-drawn part. The power section 21 also includes a plurality of power semiconductors 23 which are likewise connected with the power bus 24 via plug-in connections 26. The power semiconductors 23 may, for example, comprise MOSFETs. Both the capacitors 22 and the power semiconductors 23 are connected by the power bus 24. Cooling component 30 is provided for removing the heat losses generated in the component part 11 by the power semiconductors 23 and capacitors 22 during the operation of the power electronics 20. The cooling component 30 may be constructed as an aluminum deep-drawn section or extruded aluminum part and has a substantially U-shaped cross section. The cooling component 30 has two side legs 31 and a base region 32. The capacitors 22 are arranged in a space 33 formed by the side legs 31 and the base region 32, so that cooling of the capacitors may be effected in a

lateral direction and a downward direction in the space 33. The power semiconductors 23 are arranged on the outside of the side legs 31 of the cooling components 30, which ensures a lateral cooling of the power semiconductors 23 via the side legs 31. A cooling duct 34 is arranged through the side legs 31. With reference to FIGS. 2-4, the coolant may be the coolant circulating in a coolant circuit of an air conditioning system. To achieve efficient cooling action, the cooling component 30 is arranged with the capacitors 22 and the power semiconductors 23 such that a heat exchange can occur directly between the power electronics 20 and the cooling component 30.

In another embodiment, cooling of the component part 11 is effected via a cooling device comprising an air conditioning system 50. The air conditioning system 50 has a closed coolant circuit 51 through which a cooling medium circulates which is liquid in its initial state. An air conditioning compressor 52 is arranged in the coolant circuit 51 for drawing in gaseous coolant from an evaporator 54, compressing the coolant and pushing the coolant to a condenser 53. Further, the component part 11 (i.e., the power electronics 20 or the electric machine 70) of the control device which is to be cooled is inserted in the coolant circuit 51 in front of the evaporator 54. The individual components of the coolant circuit 51 are connected with one another via line segments 56. Weimer does not disclose a condenser of an air conditioning system of a vehicle thermally communicating with an electronic control device to remove heat from the electronic control device due to a phase-change of coolant in the condenser.

U.S. Patent No. 6,116,040 to Stark discloses an apparatus for cooling the power electronics of a refrigeration compressor drive. A refrigeration system 10 includes a series of refrigerant lines 12 that operatively connects the various system components. The system further

includes a condenser 13 that is connected to the outlet side of a compressor 15 by means of a refrigerant line 12. The compressor motor is equipped with a variable frequency drive (VFD) 25 that controls the motor speed. The VFD typically contains power electronics that require cooling in order for the drive to operate under optimum conditions over the operating range of the system. As illustrated in FIG. 1, the power electronic components of the VFD are mounted directly upon a heat sink 30 that forms part of what is herein referred to as the VFD evaporator 29. The heat sink is fabricated from a block of material that has a high coefficient of thermal conductivity such that the heat energy generated by the power electronic components is rapidly drawn away from and absorbed into the heat sink. An internal flow channel 32 is mounted within the block of material. The channel follows a tortuous path of travel through the block of material to provide for a maximum amount of contact area between the channel and the heat sink. Stark does not disclose an electronic control device for receiving power from a power source and a condenser of an air conditioning system of a vehicle thermally communicating with the electronic control device.

In contradistinction, claim 1 claims the present invention as a phase-change cooling system for a vehicle including an electronic control device for receiving power from a power source and having a first temperature. The phase-change cooling system also includes a condenser of an air conditioning system of the vehicle thermally communicating with the electronic control device and having a second temperature less than the first temperature to remove heat from the electronic control device due to a phase-change of coolant in the condenser.

The United States Court of Appeals for the Federal Circuit (CAFC) has stated in determining the propriety of a rejection under 35 U.S.C. § 103, it is well settled that the obviousness of an invention cannot be established by combining the teachings of the prior art

absent some teaching, suggestion or incentive supporting the combination. See In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 227 U.S.P.Q. 657 (Fed. Cir. 1985); ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 221 U.S.P.Q. 929 (Fed. Cir. 1984). The law followed by our court of review and the Board of Patent Appeals and Interferences is that “[a] prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art.” In re Rinehart, 531 F.2d 1048, 1051, 189 U.S.P.Q. 143, 147 (C.C.P.A. 1976). See also In re Lalu, 747 F.2d 703, 705, 223 U.S.P.Q. 1257, 1258 (Fed. Cir. 1984) (“In determining whether a case of prima facie obviousness exists, it is necessary to ascertain whether the prior art teachings would appear to be sufficient to one of ordinary skill in the art to suggest making the claimed substitution or other modification.”)

None of the references cited, either alone or in combination with each other, teaches or suggests the claimed invention of claim 1. Specifically, Weimer ‘039 merely discloses an electric system having a cooling component for removing heat losses generated in a component part by power semiconductors and capacitors during the operation of power electronics. Weimer ‘039 lacks a condenser of an air conditioning system of a vehicle thermally communicating with an electronic control device and having a second temperature less than a first temperature to remove heat from the electronic control device due to a phase-change of coolant in the condenser. In Weimer ‘039, the cooling of the component part 11 is effected via a cooling device comprising an air conditioning system 50 and does not remove heat from the component part 11 due to a phase-change of coolant in a condenser of an air conditioning system of a vehicle.

Stark '040 merely discloses an apparatus for cooling the power electronics of a refrigeration compressor drive in which a refrigeration system has a compressor motor equipped with a variable frequency drive (VFD) mounted directly upon a heat sink that forms part of the VFD evaporator. Stark '040 lacks an electronic control device for receiving power from a power source and a condenser of an air conditioning system of a vehicle thermally communicating with the electronic control device to remove heat from the electronic control device due to a phase-change of coolant in the condenser. In Stark '040, the variable frequency drive (VFD) is mounted directly upon a heat sink 30 that forms part of the VFD evaporator and does not remove heat from the VFD 25 due to a phase-change of coolant in a condenser of an air conditioning system of a vehicle. As such, there is no motivation or suggestion for combining Weimer '039 and Stark '040 together.

The present invention sets forth a unique and non-obvious combination of a phase-change cooling system that removes heat by sensible heat differential and, to a higher degree, by the thermally driven phase-change of the liquid refrigerant present in the condenser of the air conditioning system. The references, if combinable, fail to teach or suggest the combination of a phase-change cooling system for a vehicle including an electronic control device for receiving power from a power source and having a first temperature and a condenser of an air conditioning system of the vehicle thermally communicating with the electronic control device and having a second temperature less than the first temperature to remove heat from the electronic control device due to a phase-change of coolant in the condenser as claimed by Applicant.

Further, the CAFC has held that “[t]he mere fact that prior art could be so modified would not have made the modification obvious unless the prior art suggested the

desirability of the modification”. In re Gordon, 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). The Examiner has failed to show how the prior art suggested the desirability of modification to achieve Applicant’s invention. Thus, the Examiner has failed to establish a case of prima facie obviousness. Therefore, it is respectfully submitted that claim 1 and the claims dependent therefrom are allowable over the rejection under 35 U.S.C. § 103.

As to claim 12, claim 12, as amended, clarifies the invention claimed as a phase-change cooling system for a vehicle including a power source and an electronic control device for receiving power from the power source and having a first temperature. The phase-change cooling system also includes a condenser of an air conditioning system of the vehicle having a thermal interface contacting the electronic control device and having a second temperature less than the first temperature to remove heat from the electronic control device due to a phase-change of coolant in the condenser. Claim 20 has been amended similar to claim 12 and is directed to a vehicle.

None of the references cited, either alone or in combination with each other, teaches or suggests the claimed invention of claims 12 and 20. Specifically, Weimer ‘039 merely discloses an electric system having a cooling component for removing heat losses generated in a component part by power semiconductors and capacitors during the operation of power electronics. Weimer ‘039 lacks a condenser of an air conditioning system of a vehicle having a thermal interface contacting an electronic control device and having a second temperature less than a first temperature to remove heat from the electronic control device due to a phase-change of coolant in the condenser. In Weimer ‘039, the cooling of the component part 11 is effected via a cooling device comprising an air conditioning system 50 and does not remove heat from the component part 11 via a condenser of an air conditioning

system of a vehicle having a thermal interface contacting the component part 11.

Stark '040 merely discloses an apparatus for cooling the power electronics of a refrigeration compressor drive in which a refrigeration system has a compressor motor equipped with a variable frequency drive (VFD) mounted directly upon a heat sink that forms part of the VFD evaporator. Stark '040 lacks an electronic control device for receiving power from a power source and a condenser of an air conditioning system of a vehicle having a thermal interface contacting an electronic control device to remove heat from the electronic control device due to a phase-change of coolant in the condenser. In Stark '040, the variable frequency drive (VFD) is mounted directly upon a heat sink 30 that forms part of the VFD evaporator and does not remove heat from the VFD 25 via a condenser of an air conditioning system of a vehicle having a thermal interface contacting the VFD 25. As such, there is no motivation or suggestion for combining Weimer '039 and Stark '040 together.

The present invention sets forth a unique and non-obvious combination of a phase-change cooling system that removes heat by sensible heat differential and, to a higher degree, by the thermally driven phase-change of the liquid refrigerant present in the condenser of the air conditioning system. The references, if combinable, fail to teach or suggest the combination of a phase-change cooling system for a vehicle including a power source, an electronic control device for receiving power from the power source and having a first temperature, and a condenser of an air conditioning system of the vehicle having a thermal interface contacting the electronic control device and having a second temperature less than the first temperature to remove heat from the electronic control device due to a phase-change of coolant in the condenser as claimed by Applicant. Thus, the Examiner has failed to establish a

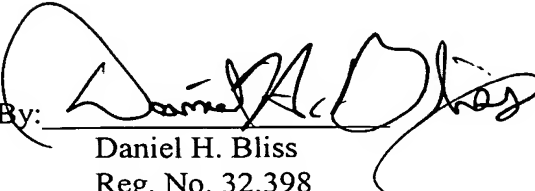
case of prima facie obviousness. Therefore, it is respectfully submitted that claims 12 and 20 and the claims dependent therefrom are allowable over the rejection under 35 U.S.C. § 103.

Claims 9 through 11 and 18 were rejected under 35 U.S.C. § 103 as being unpatentable over Weimer '039 in view of Stark '040 and further in view of Katai et al. (U.S. Patent No. 5,974,812). Applicant respectfully traverses this rejection for the same reasons given above to claims 1 and 12.

Obviousness under § 103 is a legal conclusion based on factual evidence (In re Fine, 837 F.2d 1071, 1073, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988), and the subjective opinion of the Examiner as to what is or is not obvious, without evidence in support thereof, does not suffice. Since the Examiner has not provided a sufficient factual basis, which is supportive of his/her position (see In re Warner, 379 F.2d 1011, 1017, 154 U.S.P.Q. 173, 178 (C.C.P.A. 1967), cert. denied, 389 U.S. 1057 (1968)), the rejections of claims 1 through 20 is improper. Therefore, it is respectfully submitted that claims 1 through 20 are allowable over the rejections under 35 U.S.C. § 103.

Based on the above, it is respectfully submitted that the claims are in a condition for allowance, which allowance is solicited.

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Date: February 7, 2006

Attorney Docket No.: GP-303183